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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/671,935
Filing Date: September 29, 2003
Appellant(s): GUSTAVSON ET AL.

Gustavson, et al.
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 03/03/2008 and 04/14/2008 appealing from the Office action mailed 10/04/2007.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

Fred et al., Superscalar GEMM-based Level 3 BLAS-The On-going Evolution of Portable and High-Performance Library, Applied Parallel Computing published 1998, Springer, pages 207-215.

Philip et al., PLAPACK: Parallel Linear Algebra Package Design Overview, 1997, IEEE Proceedings of the ACM/IEEE SC 97 Conference, pages 1-14.

6,357,041 Pingali et al. 03-2002

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

A. Whether claims 1-20 are directed to non-statutory subject matter under 35 U.S.C. 101.

B. The anticipation rejection for claims 1, 6, 7, 12-13 and 18 based on primary reference by Fred et al. ("Superscalar GEMM-based Level 3 BLAS – The On-going Evolution of Portable and High-Performance Library").

C. The obviousness/unpatentable rejection for claims 3-4, 9-10 and 15-16 based on combination of the above primary reference by Fred et al. with secondary reference by Pingali et al. (U.S. Patent No. 6,357,041).

D. The obviousness/unpatentable rejection for claims 19-20 based on combination of the above primary reference by Fred et al. with secondary reference by Philip et al. ("PLAPACK: Parallel Linear Algebra Package Design Overview").

E. The provisional double patenting obviousness-type rejection for claims 1, 5-7, 11-13 and 17-18 based on claims 21-22 of copending application 10/671,934 and for claims 3-4, 9-10 and 15-16 based on these two claims of copending application 10/671,934 further in view of Pingali et al. (U.S. Patent No. 6,357,041).

Claim Rejections - 35 USC § 101

1. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

2. Claims 13-18 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.

Claims 13-18 are directed to a machine-readable storage medium for embodying a program of a machine-readable instructions to carry the steps of method. However, the original specification page 24, particularly lines 8-15, discloses or defines the machine-readable storage medium as a non-tangible medium as signal-bearing media including transmission media such as digital and analog and communication links and wireless. Therefore, claims 13-18 are directed to non-statutory subject matter.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1, 6-7, 12-13, and 18 are rejected under 35 U.S.C. 102(b) as being anticipated by Fred et al. ("Superscalar GEMM-based Level 3 BLAS – The On-going Evolution of a Portable and High-Performance Library").

Re claim 1, Fred et al. disclose a method of improving at least one of speed and efficiency when executing a level 3 dense linear algebra processing on a computer (e.g. abstract and first four lines under the introduction section in page 207), said method comprising: automatically setting an optimal machine state on said computer for said processing (e.g. first paragraph in page 208, and section 2 in page 208 wherein the

automation is done by the kernel level; page 211 the first two paragraph) by selecting an optimal matrix subroutine from among a plurality of matrix subroutines stored in a memory (e.g. section 3 in pages 208-209 and section 3.2 in pages 210-211 wherein as an instant the DGEMM routine is optimal from all the routines in page 210) that could alternatively perform a level 3 matrix multiplication processing (e.g. first four lines under the introduction section in page 207).

Re claim 6, Fred et al. further disclose plurality of matrix subroutines comprises six possible matrix subroutines that could alternatively be used for level 3 matrix multiplication processing (e.g. abstract and the first four lines under the introduction section in page 207 and section 3.2 the sixth subroutine is the optimal DGEMM in pages 210-211).

Re claim 7, it is an apparatus claim having similar limitations cited in claim 1. Thus, claim 7 is also rejected under the same rationale as cited in the rejection of rejected claim 1.

Re claim 12, it is an apparatus claim having similar limitations cited in claim 6. Thus, claim 12 is also rejected under the same rationale as cited in the rejection of rejected claim 6.

Re claim 13, it is a machine-readable storage medium claim having similar limitations cited in claim 1. Thus, claim 13 is also rejected under the same rationale as cited in the rejection of rejected claim 1.

Re claim 18, it is a machine-readable storage medium claim having similar limitations cited in claim 6. Thus, claim 18 is also rejected under the same rationale as cited in the rejection of rejected claim 6.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 3-4, 9-10, and 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fred et al. ("Superscalar GEMM-based Level 3 BLAS – The On-going Evolution of a Portable and High-Performance Library") in view of Pingali et al. (U.S. 6,357,041).

Re claims 3-4, Fred et al. fail to disclose matrix subroutine comprises a substitute of a subroutine from a LAPACK (Linear Algebra PACKage), which comprises a BLAS Level 3 L1 cache kernel. However, Pingali et al. disclose in Figures 1-4 matrix subroutine comprises a substitute of a subroutine from a LAPACK (Linear Algebra PACKage), which comprises a BLAS Level 3 L1 cache kernel (e.g. col. 4 line 54 to col. 5 line 14 wherein the subroutine in standard LAPACK is not optimal for execution).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention is made to replace the routine as a substitute of a subroutine from a LAPACK (Linear Algebra PACKage), which comprises a BLAS Level 3 L1

cache kernel as seen in Pingali et al.'s invention into Fred et al.'s invention because it would enable to enhance data reuse and speed (e.g. col. 2 line 57 to col. 3 line 35).

Re claim 9, it is an apparatus claim having similar limitations cited in claim 3. Thus, claim 9 is also rejected under the same rationale as cited in the rejection of rejected claim 3.

Re claim 10, it is an apparatus claim having similar limitations cited in claim 4. Thus, claim 10 is also rejected under the same rationale as cited in the rejection of rejected claim 4.

Re claim 15, it is a machine-readable storage medium claim having similar limitations cited in claim 3. Thus, claim 15 is also rejected under the same rationale as cited in the rejection of rejected claim 3.

Re claim 16, it is a machine-readable storage medium claim having similar limitations cited in claim 4. Thus, claim 16 is also rejected under the same rationale as cited in the rejection of rejected claim 4.

7. Claims 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fred et al. ("Superscalar GEMM-based Level 3 BLAS – The On-going Evolution of a Portable and High-Performance Library") in view of Philip et al. ("PLAPACK: Parallel Linear Algebra Package Design Overview").

Re claim 19, Fred et al. disclose a method of providing a service involving at least one of solving and applying a scientific/engineering problem (e.g. section 1 introduction section in page 207), said method comprising at least one of: using a linear algebra

software package that improves at least one of speed and efficiency to perform one or more matrix processing operations (e.g. abstract and the first four lines under the introduction section in page 207), wherein said linear algebra software package achieves the improved speed or efficiency by selecting an optimal matrix subroutine from among a plurality of matrix subroutines that alternatively can perform a matrix multiplication processing (e.g. section 2 and section 32), thereby automatically setting a computer into an optimal machine state for performing said matrix multiplication processing (e.g. pages 210-211) provide a consultation for solving a scientific/engineering problem using said linear algebra software package (e.g. output of result).

Fred et al. fail to disclose step of transmitting a result of said linear algebra software package on at least one of a network, a signal-bearing medium containing machine-readable data representing said result, and a printed version representing said result; and receiving a result of said linear algebra software package on at least one of a network, a signal-bearing medium containing machine-readable data representing said result, and a printed version representing said result. However, Philip et al. disclose step of transmitting a result of said linear algebra software package on at least one of a network, a signal-bearing medium containing machine-readable data representing said result, and a printed version representing said result; and receiving a result of said linear algebra software package on at least one of a network, a signal-bearing medium containing machine-readable data representing said result, and a printed version representing said result (e.g. abstract and page 1 under the introduction section wherein the library is distributed to network processors for processing).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention is made to add step of transmitting a result of said linear algebra software package on at least one of a network, a signal-bearing medium containing machine-readable data representing said result, and a printed version representing said result; and receiving a result of said linear algebra software package on at least one of a network, a signal-bearing medium containing machine-readable data representing said result, and a printed version representing said result as seen in Philip et al.'s invention into Fred et al.'s invention because it would enable to enhance computation (e.g. page 1 under the introduction section).

Re claim 20, Fred et al. disclose the BLAS Level 3 L1 cache kernel (e.g. abstract and introduction section in page 207). Fred et al. fail to disclose the BLAS routine from the LAPACK. However, Philip et al. disclose in the BLAS routine from the LAPACK (e.g. page 6).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time the invention is made to add the BLAS routine from the LAPACK as seen in Philip et al.'s invention into Fred et al.'s invention because it would enable to perform parallel dense linear algebra (e.g. introduction section in page 1).

(10) Response to Argument

A. Whether claims 1-20 are directed to non-statutory subject matter under 35 U.S.C. 101.

The applicant argues in pages 6-7, generally for claims 1-20 rejected under 35 U.S.C. 101 as lacking of practical application and having preemption issue, that the claims are directed to useful, concrete, and tangible result as setting an optimal machine state on the computer.

Upon extensive reconsider of the claimed invention along with the Applicant's arguments, the examiner believes these claims 1-20 are directed to useful, concrete, and tangible result as required under 35 U.S.C. 101 as following reasons:

(1) The claims are concrete since the steps within the claims are consistent and predictable.

(2) The claims are useful as clearly addressed/stated in the specification and the claims which improving the system performance for the linear algebra routines by efficiently arranging/structuring the matrix data into physical cache for ease of accessing the matrix data.

(3) The claims are tangible by setting an optimal machine state by logically selecting an optimal/best matrix subroutine from among a plurality of matrix subroutines wherein the determination of selecting step is based on the physical size of the cache.

Therefore, the rejection under 35 U.S.C. 101 of claims 1-12 and 19-20 has been fully reconsidered and withdrawn. However, claims 13-18 are still rejected as directed to non-tangible medium as below.

The applicant argues in pages 8-10, for claims 13-18 rejected under 35 U.S.C. 101 as directed to non-tangible medium, that first claims 13-18 direct to a process which is statutory by reason of being one of the four categories; and second, the wording "machine-readable storage medium" clearly includes ROM and RAM containing the machine-readable instruction as well as the standalone disks or diskettes. Further, the applicant also addresses the signals with computers which are already controlled by internal signals that are based on the electromagnetic spectrum, including those signals used to define the process steps being executed on that machine.

The examiner respectfully submits the original specification in page 24 lines 8-15 clearly defined the type of medium within the claims 13-18 including non-tangible medium as signal-bearing media including transmission media such as digital and analog and communication links and wireless. Signal per se claim(s) is not statutory as clearly addressed in the MPEP section 2106. In order to determine whether the claims should rejected under 35 U.S.C. 101, the claims must go through several tests wherein determining the type of medium is one of the tests to determine the patentability of the claims. Under this particular test, the claims fail to direct to a tangible medium as required under 35 U.S.C. 101 guideline. In addition, having the word "machine-readable storage medium" within the claims would not inherently include only tangible ROM and RAM, but rather the examiner must find the definition within the specification or else give its the broadest interpretation. In this case, the specification clearly defines the machine-readable storage medium is including a non-tangible medium as signal-bearing

media including transmission media such as digital and analog and communication links and wireless. Finally, the examiner does not quite understand how the electromagnetic spectrum within the computers would relevant to the current claims.

B. The anticipation rejection for claims 1, 6, 7, 12-13 and 18 based on primary reference by Fred et al. ("Superscalar GEMM-based Level 3 BLAS – The On-going Evolution of Portable and High-Performance Library").

The applicant argues in page 11 fourth paragraph for claims rejected under 35 U.S.C. 102(b) that there is no suggestion in the Gustavson publication (e.g. herein as Fred et al.) using a selected one of six possible kernels.

The examiner respectfully submits that the current independent claim language fails to define the following: 1) how an optimal kernel/subroutine is selected among others; 2) what are the plurality kernels/subroutines; and 3) optimal in what sense/aspect of the claimed invention. Rather, the claim broadly requires only a selection of a kernel/routine out of a plurality of kernels/routines for computing level 3 matrix multiplication. Later on in dependent claim 6, it requires the number of kernels/routines to be six. However this limitation, six kernels/routines, is not found or cited in the independent claims as generally alleged by the applicant.

Back to the applicant's argument, the six possible kernels/subroutines for performing level 3 matrix multiplication are clearly seen or address in the primary reference by Fred et al., particularly in pages 210-211 under section 3.2 "Improved performance for the superscalar library", wherein the kernels/subroutines DSYMM,

DSYRK, DSYR2K, DTRMM, DTRSM, and tuned DGEMM are the six possible kernels/subroutines as required by the claimed invention. These six kernels/subroutines are stored in the computer as kernels/subroutines within the superscalar library for specifically performing level 3 matrix multiplication at close to peak performance when called upon alternatively based on the type and/or size of matrix data… The support of selection is logically seen within the abstract in page 207 and section 3.2 in page 210-211 wherein depending on many factors (e.g. speed, type of data as triangular operands, size of data 500x500…), a kernels/subroutines within the superscalar library is selected and executed to perform level 3 matrix multiplication at close to peak performance (e.g. optimal). Therefore, the primary reference by Fred et al., particularly in pages 210-211 under section 3.2 "Improved performance for the superscalar library", logically disclose all the broadly limitations cited in claimed invention.

The applicant argues in page 11 last two paragraphs for claims rejected under 35 U.S.C. 102(b) that the citation of the rejection does not suggest the availability of alternative kernels, let alone selecting an optimal kernel form among six possible kernels.

The examiner respectfully submits that the primary reference by Fred et al. clearly disclose these kernels/subroutines DSYMM, DSYRK, DSYR2K, DTRMM, DTRSM, and tuned DGEMM are within the superscalar library. Thus, the availability of these possible kernels/subroutines is technically existed as the kernels/subroutines within the library for performing level 3 matrix multiplication upon call. As previously mention, the applicant or the claim does not clearly define the term "optimal". For the examination

purposes, the examiner considers the optimal kernel/subroutine is the most desired kernel/subroutine from among a plurality of kernels/subroutines. This optimal kernel/subroutine is clearly seen in the primary reference by Fred et al., particularly in pages 210-211 under section 3.2 "Improved performance for the superscalar library", wherein each of the kernels/subroutines DSYMM, DSYRK, DSYR2K, DTRMM, DTRSM, and tuned DGEMM is optimal/desired as given criteria/factors (e.g. speed, type of data as triangular operands, size of data 500x500…).

The applicant argues in page 13 last paragraph for claims rejected under 35 U.S.C. 102(b) that nowhere within the citation suggest an alternative kernels or a selection of an optimal kernel from among a plurality of kernels that could alternatively be used.

The examiner respectfully submits that the above alleged limitations are clearly seen in the primary reference by Fred et al., particularly in pages 210-211 under section 3.2 "Improved performance for the superscalar library", wherein the kernels/subroutines DSYMM, DSYRK, DSYR2K, DTRMM, DTRSM, and tuned DGEMM are the alternative kernels within the superscalar library. Obviously, these kernels/subroutines have same functionality which perform level 3 matrix multiplication but each kernel/subroutine is optimal/desired as given criteria/factors (e.g. speed, type of data as triangular operands, size of data 500x500…). Beside when performs level 3 matrix multiplication, only a desired kernel/subroutine is need to perform the multiplication. Thus, a desired kernel/subroutine is selected among the kernels/subroutines within the

superscalar library given criteria/factors (e.g. speed, type of data as triangular operands, size of data 500x500…) to perform level 3 matrix multiplication.

Finally, the applicant argues in page 14 first paragraph for claims rejected under 35 U.S.C. 102(b) that the kernels/subroutines in the citation do not satisfy the plain meaning of the claim language since these kernels/subroutines are not relative to each other nor any of these subroutines is an optimal alternative subroutine to the others.

The examiner respectfully submits that the claims, as previously mention, do not define what is the kernel(s)/subroutine(s) and how it is selected among others. Rather, the claim broadly requires only a selection of a kernel/routine out of a plurality of kernels/routines for computing level 3 matrix multiplication. Thus, the primary reference by Fred et al. clearly meet/satisfy all the general/broad meaning of the claim language as the optimal kernel/subroutine is selected among a plurality of kernels/subroutines. This optimal kernel/subroutine is clearly seen in the primary reference by Fred et al., particularly in pages 210-211 under section 3.2 "Improved performance for the superscalar library", wherein each of the kernels/subroutines DSYMM, DSYRK, DSYR2K, DTRMM, DTRSM, and tuned DGEMM is optimal/desired as given criteria/factors (e.g. speed, type of data as triangular operands, size of data 500x500…).

C. <u>The obviousness/unpatentable rejection for claims 3-4, 9-10 and 15-16 based on combination of the above primary reference by Fred et al. with secondary reference by Pingali et al. (U.S. Patent No. 6,357,041).</u>

The applicant argues in page 15 second paragraph for claims 3-4, 9-10 and 15-16 that the secondary reference by Pingali et al. does not overcome the deficiency of the primary reference. Thus, claims 3-4, 9-10 and 15-16 are also clearly patentable over this publication, even if combined with this secondary reference.

The examiner respectfully submits that it is unclear what deficiency of the primary reference as the applicant referring to. For the purposes of argument, the examiner assumes the deficiency as argued in the above argument section B. However, the examiner has clearly pointed out in the above response and rejection that the alone primary reference by Fred et al. clearly addresses every single limitation. Thus, there is no deficiency of the primary reference in the above argument section B that must be shown or disclosed in the secondary reference by Pingali et al.

D. The obviousness/unpatentable rejection for claims 19-20 based on combination of the above primary reference by Fred et al. with secondary reference by Philip et al. ("PLAPACK: Parallel Linear Algebra Package Design Overview").

The applicant argues in page 15 fourth paragraph for claims 19-20 that neither secondary reference by Pingali et al. nor third reference by Philip et al. overcomes the deficiency of the primary reference by Fred et al.

The examiner similarly but respectfully submits that it is unclear what deficiency of the primary reference as the applicant referring to. For the purposes of argument, the examiner assumes the deficiency as argued in the above argument section B. However, the examiner has clearly pointed out in the above response and rejection that the alone

primary reference by Fred et al. clearly addresses every single limitation. Thus, there is no deficiency of the primary reference in the above argument section B that must be shown or disclosed in either the secondary reference by Pingali et al. or the third reference by Philip et al.

E. The provisional double patenting obviousness-type rejection for claims 1, 5-7, 11-13 and 17-18 based on claims 21-22 of copending application 10/671,934 and for claims 3-4, 9-10 and 15-16 based on these two claims of copending application 10/671,934 further in view of Pingali et al. (U.S. Patent No. 6,357,041).

Applicant's arguments, see pages 16-17, filed 04/10/2008 and 04/14/2008, with respect to claims 1, 3-7, 9-13 and 15-18, as different compare to claims 21-22 of copending application 10/671,934, have been fully considered and are persuasive. The provisional double patenting obviousness-type rejection of claims 1, 3-7, 9-13 and 15-18 has been withdrawn.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

May 29, 2008

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